Preliminary Economic Contributions to USDA-ARS Biological Control of *Arundo donax* in the Rio Grande Basin

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Problem and Objective

- Consumption of scarce water resources exacerbated by the unmitigated growth of giant reed.
- Analyze the economics of proposed biological control management program.
- Estimate the program's life-cycle cost and the potential economic benefit of recaptured water.

Giant Reed (*Arundo donax*)

- Perennial, aquatic invasive weed that thrives along riparian areas of the Rio Grande Basin.
- Native to the Mediterranean Basin and was imported by immigrants for thatching roofs and later used for erosion control (Jackson et al. 2002).
- 10,000-20,000 acres between Laredo and Del Rio in 2002 and an estimated 60,000 acres in 2007 (Goolsby).

Biology

- Exhibits a rapid growth/expansion rate.
- Grows to a height of 20-30 feet tall (Bell 1997) with a biomass of 8.3 dry tons per acre (Hoshovsky 1986).
- Consumes approximately 49 gallons per year for every square foot of giant reed (Jackson et al. 2002).
  - ❖Reducing water to arid region
  - ❖Native vegetation consumes 1/3 this amount
- Re-channelizes water stream, creating a faster, deeper flow.
- Undercuts roots, causing large stands to break off, float downstream, and damage infrastructure in its path.
- Reproduces vegetatively through nodes located throughout the plant and by sections of the rhizome (Wijte 2005).
- Expansive root system: rhizome can grow to approximately three feet thick with fibrous roots reaching approximately 16 feet in depth (Oakins 2001).

Pictures Taken at the Quarantine Facility at Moore Air Base in Mission, Texas

Photos by : Edward Rister, Emily Seawright, and Allen Sturdivant

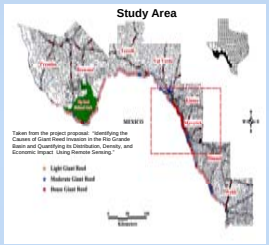
Control Measures – Traditional and Potential

- Unmitigated growth can be managed using mechanical and chemical control methods.
  - ❖ Measures are temporary, costly, cause damage to non-target vegetation and are potentially contentious (i.e., international chemical-use disagreement with Mexico).
- United States Department of Agriculture-Agricultural Research Service (USDA-ARS) proposed a biological control program for the management of the growth and spread of this invasive plant.
  - ❖ Four herbivore insect species under investigation to determine suitability and potential impact on giant reed.

Potential Annual Gross Benefits (millions of dollars) of Mitigating 60,000 acres of Arundo donax in the Rio Grande Basin Riparian Area, 2008.

Value of Water ($ per ac-ft)[a]												
	$50			$75			$100			$200		
	Net Water Savings Per Acre			Net Water Savings Per Acre			Net Water Savings Per Acre			Net Water Savings Per Acre		
Annual Water Consumption Rate (ac-ft per acre)	5%	25%	50%	5%	25%	50%	5%	25%	50%	5%	25%	50%
3.80[b]	$0.57	$2.85	$5.70	$0.86	$4.28	$8.55	$1.14	$5.70	$11.40	$2.28	$11.40	$22.80
4.37[c]	0.65	3.27	6.54	0.98	4.91	9.81	1.31	6.54	13.08	2.62	13.08	26.16
5.00[d]	0.75	3.75	7.50	1.13	5.63	11.25	1.50	7.50	15.00	3.00	15.00	30.00

[a] Source: Derived from Texas Agrilife Extension Service Crop Enterprise Budgets (2006) and Rogers et al. (2008).
[b] Source: Derived from Jackson (2002).
[c] Source: Derived from Bell (1997).
[d] Source: Texas AgriLife Extension Service Crop Enterprise Budgets (2006)



Data and Methods

- Temporal growth curves for height, area, and density were determined using the logistic growth function.
- Residual returns to water were calculated using Extension crop budgets for District 12.
- After the total amount of cane was determined and entered into the growth equation, a value was calculated for the amount of water consumed.
- The temporal rate of growth associated with the biological control agents is currently being researched at the USDA-APHIS quarantine facility located on Moore Air Base in Mission, Texas.
- These results allow for the calculation of the net water saved, considering native replacement species.

Preliminary Results and Potential Implications

- Analysis currently in process for determining the net impact of this project.
- Preliminary results indicate an amount of 262,300 acre-feet of water potentially saved from the elimination of giant reed, for a total annual value ranging from $0.57 million to $30 million for 2007.

Qualifications and Limitations to Results

- The results are preliminary and represent probable bounds of potential water savings and associated value from mitigating the growth of *Arundo donax*.
- A range of effectiveness is assumed regarding the potential efficacy of the biological control agents until further data is available.
- Water uptake of giant reed is assumed to be constant throughout the year (possibly an overestimate).
- Conveyance losses associated with the reduction of giant reed need to be considered.
- Benefits are currently quantified only in the Rio Grande Basin riparian area; other potential benefits need to be quantified.

Future Research

- Confirm and improve growth curve functions.
- Improve water-parameter related data.
- Confirm efficacy of beneficial insects.
- Assimilate biological control cost-related data.

Once these issues are resolved, a more precise estimate of the potential net impact of the program will be available.

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